that Dr. Lartet assigns to the celebrated Jebel Usdom, or Salt Mountain of the Dead Sea, a place within the Cretaceous system. But Hull's party have obtained evidence which leads them to believe that Jebel Usdom is not of Cretaceous age, but rather belongs to the marls of the Dead Sea basin. This, in fact, is almost the only point where their conclusions differ materially from those of the French geologist.

Neither in Palestine nor in Egypt is there any sharp line of demarcation between the Chalk and the Tertiary rocks, but the chalky sediments of the older Eocene follow those of the Upper Chalk with hardly any variation in their characters. And yet, according to Zittel, the palæontological boundary between the Chalk and the Eocene is clearly defined, notwithstanding the continuity of marine deposits. That author had never observed either in or above the oldest Nummulitic bed a single characteristic chalk fossil; neither did he ever find a nummulite in the chalk strata.

d. Post-nummulitic Rocks outside the area of the Dead Sea basin.—There is considerable difference of opinion as to the age of the formations that were deposited subsequent to the upheaval of the Cretaceo-nummulitic sea-bed. Those at the Isthmus of Suez are especially interesting. Dawson has named them the "Isthmian deposits," and considers them to be later than the Miocene. They occupy the highest land just north of Ismailia—thin-bedded grey limestones with vermicular holes resting on marls, sands, and clays, mostly destitute of fossils, but with some layers holding fresh-water shells, especially *Ætheria caillaudi*, which is also found in the Chalouf cutting. He concludes that a branch of the Nile discharged hereabouts, not into a marine estuary, but into a lake sometimes salt and sometimes fresh. The greater part of these "Isthmian deposits" resembled those of the terraces of the Dead Sea, presently to be considered. The period of their formation was a continental one, pliocene or post-glacial.

The subject of the recent raised beaches of the Red Sea, &c., and the probable bearing of these upon the question of the route of the Exodus was also discussed.

II. *The Wady Arabah, and the Dead Sea Basin.*—It was pointed out that Prof. Hull, in a lecture given at Dublin two years ago, maintained the River theory in opposition to the Lake basin theory, insisting that such a river flowed southerly from the Lebanon through the gorge of the Arabah into the Red Sea. During the pluvial period, according to this author, the overflow of the Jordanic lake was again through the Arabah in a southward direction. Doubts were thrown upon this hypothesis, since, if the present relative levels were maintained, an overflow would take place through the Pass of Jezreel, at a point only 285 feet above sea-level, leaving the watershed of the Arabah still 375 feet above such a Jordanic lake. These points were again brought out in considering the scheme for a Jordan Valley canal.

An account of the physical and geological structure of the Arabah was given, based chiefly upon Hull's summary, and on the work of the Royal Engineers in the late survey. The longitudinal section, by Major Kitchener and Sergeant-Major Armstrong, is a very fine piece of work, and sets at rest for ever the question of level in the long valley between the Red Sea and the Dead Sea, besides supplying an admirable *coup d'œil* of the eastern flank of one of the most extraordinary valleys in the world. The great Dead Sea fault recognised by Von Buch, Hitchcock, Lartet, and others was proved to pass down the Arabah, clinging to the roots of the eastern mountains. Prof. Hull's party observed it in several places, and two cross-sections are given, showing the sedimentaries faulted against the crystalline rocks. The parallel faults near the base of Mount Hor serve to repeat the phenomena with very curious and picturesque results, as is well illustrated by Prof. Hull in his book, "Mount Seir."

The physical problems connected with these dislocations, and with the undoubted existence of the Dead Sea hollow as an independent lake-basin, dating back from a high antiquity, were partially discussed The Dead Sea basin is separated from the southward portion of the Arabah by a watershed consisting of hard limestone covered in part by sands and gravels. This has an elevation of 660 feet, and is 45 miles from the head of the Gulf; 29 miles further north the sea-level is again reached. Hence the mass of land, through which the southern section of the Jordan Valley canal would have to be cut, is 74 miles long, with a maximum height of 660 feet, and a probable average of 250 feet.

Further proof was obtained of the independent character of the basin north of the watershed in marl deposits at an elevation of 1400 feet above the present Dead Sea level; these contain species of *Melania* and *Melanopsis* identical with some of those now existing in the fresh portions of the Jordanic basin. Hence there is little doubt that we must carry the successive lakes mentioned by Capt. Conder some stages higher than had been supposed previously. It was noted also, as bearing on this subject, that the old marls of the Jordanic lakes are not so unfossiliferous as M. Lartet would lead us to suppose. Tristram describes one species of *Melania* and two of *Melanopsis* as abundant in a semi-fossil condition in several of these old marl deposits.

Next comes the consideration of a problem which results from the adoption of the independent lake-basin theory—viz. "Since the Dead Sea has no outlet, what has become of the materials that have disappeared?" Seeing that the lateral wadies are, in the main, gorges of erosion, the difficulty is still further enhanced. That there has been some connection in past time between this curious hollow and the volcanic outbursts of the Jaulan, &c., is not improbable; indeed, it has long been suspected that an explanation of the phenomenon might, in part at least, be found in this direction. There is a partially analogous case in the meridional trough with its string of charming lakes, some fresh and some salt, which, Mr. Thompson tells us, extends along the west side of the old East African volcano, Mount Kenia: the fresh-water lake, Baringo, 3200 feet above sea-level, occupies the lowest depression of this great hollow.

III. *The suggested Jordan Valley Canal.*—The remainder of the paper was occupied in considering the northern section, by which the waters of the Mediterranean are to be admitted into the Jordanic basin, so as to convert it into an inland sea. If taken through the Vale of Esdraelon into the valley of the Jâlud (Jezreel), between Little Hermon and the Gilboa range, the length would be about 25 miles, starting from the port of Haïfa under Mount Carmel. The height of land is 285 feet, and the mean depth of the cutting to the water-surface would be about 150 feet, without including the depth of the canal itself. The surface of the Vale of Esdraelon consists mainly of Post-Tertiary loams, &c., below which hard limestone, and possibly basalt, would have to be encountered. The alternative of a railway was discussed.

CHINESE INSECT-WHITE WAX

A PARLIAMENTARY paper which has recently been published (China, No. 2, 1885) contains a report of a Journey through Central Sze-chu'an, which was made by Mr. Hosie, consular agent at Chung-king, chiefly for the purpose of collecting information on the subject of insect white wax, specimens of the insect wax-trees, and forms of the wax product, at the request of Sir Joseph Hooker. The report describes the country traversed, its trade and trading capabilities, and such information as was attainable on any commercial product of the district; but the portion relating to insect white wax is the most interesting part of the paper.

"Insect tree" is the name given by the Chinese in the extreme west of Sze-chu'an to what is probably the *Ligustrum lucidum* of botanists. The point will doubtless be decided at Kew by the specimens which Mr. Hosie has sent home. It is also called the winter-green or evergreen tree; while in the east of the province it is known as the "crackling flea tree," owing, it is said, to the sputtering of the wood when burned. It is an evergreen, with leaves which spring in pairs from the branches. They are thick, dark green, glossy, ovate, and pointed. In the end of May or beginning of June the tree bears clusters of small white flowers, which give place to small seeds of a dark blue colour. In the month of May, 1883, Mr. Hosie found attached to the bark of the boughs and twigs numerous brown pea-shaped excrescences or galls, in various stages of development. In the earlier stages they looked like minute univalves clinging to the bark. The larger galls were readily detachable, and, when opened, presented either a whitey-brown pulpy mass, or a crowd of minute animals, whose movements were only just perceptible to the naked eye. Last year an opportunity of examining these galls and their contents with some minuteness in the chief wax-producing locality in the province presented itself. They are very brittle, and there was found, on opening them, a swarm of brown creatures, like minute lice, each with six legs and a pair of club *antennæ*, crawling about. The great majority of the galls also contained either a small

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white bag or cocoon, containing a chrysalis, whose movements were visible through the thin covering, or a small black beetle. This beetle also has six legs, and is provided with a long proboscis, armed with a pair of pincers. It is called by the Chinese the "buffalo," probably from its ungainly appearance. After a few days it turned out that each chrysalis developed into a black beetle, or "buffalo." If left undisturbed in the broken gall, the beetle will, heedless of the wax insects, which begin to crawl outside and inside the gall, continue to burrow with his proboscis and pincers in the inner lining of the gall, which is apparently his food. The Chinese believe that he eats his minute companions in the gall, or at any rate injures them with the pressure of his heavy body, and galls in which beetles are numerous sell cheaper than others. But careful investigation showed that the beetle does not eat the other insects, and that his purpose within the gall is a more useful one. When a gall is plucked from the insect tree an orifice is disclosed where it was attached to the bark. By this the wax insects escape. But if the gall remained attached to the tree no mode of escape would appear to be provided for them. The beetle provides this mode. With his pincers he gradually bores a hole in the covering of the gall, which is of sufficient size to allow him to escape from his imprisonment, and which allows egress at the same time to the wax insects. When the beetles were removed from the galls some of them made efforts to fly; but at that time their *elytræ* were not sufficiently developed, and they had to content themselves with crawling, a movement which, owing to the long proboscis, they performed very clumsily. Through the orifice thus created by the beetle the insects escape to the branches of the tree, if the gall be not plucked soon enough. When plucked, the galls are carried in headlong flight by bearers who travel through the night for coolness to the market towns, and every endeavour is made to preserve a cool temperature in order that the heat may not force the insects to escape from the galls during the journey.

The wax-tree is usually a stump, varying from three or four to a dozen feet in height, with numerous sprouts or branches rising from the gnarled top of the stem. The leaves spring in pairs from the branches. They are light green, ovate, pointed, serrated, and deciduous. The branches are rarely found more than six feet in length, as those on which the wax is produced are cut from the stems with it. The sprouts of one and two years' growth are too pliant, and it is only in the third year, when they are again sufficiently strong to resist the wind, that wax insects are placed on them. In June some of the trees bear bunches apparently of seeds in small pods, and specimens of these have been sent to Kew.

The wax insects are transferred to these trees about the beginning of May. They are made into small packets of twenty or thirty galls, which are inclosed in a leaf of the wood-oil tree, the edges of which are fastened together with rice-straw. These small packets are then suspended close to the branches under which they hang. A few rough holes are made in the leaf by means of a large needle, so that the insects may find their way through them to the branches. On emerging from the galls the insects creep rapidly up the branches to the leaves, where they remain for thirteen days, until their mouths and limbs are strong. During this period they are said to moult, casting off "a hairy garment," which has grown in this short time. They then descend to the tender branches, on the under sides of which they fix themselves to the bark by their mouths. Gradually the upper surfaces of the branches are also dotted with the insects. They are said not to move from the spots to which they attach themselves. The Chinese idea is that they live on dew, and that the wax perspires from the bodies of the insects. The specimens of the branches encrusted with wax show that the insects construct a series of galleries stretching from the bark to the outer surface of the wax. At an early stage of wax production an insect called by the Chinese the "wax-dog" is developed. Mr. Hosie was unable to obtain a specimen of this insect, but it was described to him as a caterpillar, in size and appearance like a brown bean. His theory (which, he confesses, is unsupported by outside evidence) is that the female of the "buffalo" beetle, already mentioned, deposits eggs on the boughs of the insect tree or the wax tree, as the case may be, and that the "wax-dog" is the offspring of the buffalo. There may possibly be a connection between this caterpillar and the gall containing the wax insects. It is said that during the night and early morning the insects relax their hold of the bark, and that during the heat of the day they again take firm hold of it. The owners of trees are in the habit, during the first month, of belabouring the trees with thick clubs to shake off the "wax-dog," which, they assert, destroys the wax insects. After this period the branches are coated with wax, and the "wax-dog" is consequently unable to reach his prey. The first appearance of wax in the boughs and twigs has been likened to a coating of sulphate of quinine. This gradually becomes thicker, until, after a period of from ninety to a hundred days, the wax in good years has attained a thickness of about a quarter of an inch. When the wax is ready, the branches are lopped off, and as much of the wax as possible is removed by hand. This is placed in an iron pot with water, and the wax, rising to the surface at melting-point, is skimmed off and placed in round moulds, whence it emerges as the white wax of commerce. The wax which cannot be removed by hand is placed with the twigs in a pot with water, and the same process is gone through. This latter is less white and of an inferior quality. But the Chinese, with their usual carefulness that nothing be lost or wasted, take the insects, which have meantime sunk to the bottom of the pot, and, placing them in a bag, squeeze them until they have given up the last drop of the wax. They finish their short, industrious existence by being thrown to the pigs. The market price of the wax is about 1*s.* 6*d.* per pound. It is used chiefly in the manufacture of candles. It melts at 160° F., while tallow melts at about 95°. In Sze-chu'an it is mixed with tallow to give the latter greater consistency, and candles, when made, are dipped in melted white wax to give them a harder sheathing and to prevent the tallow from running over when they are lighted.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—The following courses of lectures and practical demonstrations are being given this term:—

Physiology, Elementary, by Prof. Foster; Physiology of Circulation and Respiration, Dr. Gaskell; Central Nervous System, Mr. Langley; Chemical Physiology, Mr. Lea: Preparation Class for 2nd M.B., Mr. Hill.

Elementary Biology, Mr. Sedgwick; Anatomical Characters of the Races of Mankind, Prof. Macalister; Demonstrations on Topographical Anatomy of the Head and Neck, Prof. Macalister.

Morphology and Entomology of Vertebrata, Mr. Sedgwick; Elementary Osteology and Advanced Course on Arthropoda, Mr. Harmer; Morphology of Vertebrata, Mr. Weldon; Development of Limbs of Vertebrata, Mr. Gadow.

Elementary Botany, Prof. Babington; Morphology of Cryptogams, with practical work, Elementary and Advanced Courses, Dr. Vines; Demonstrations in Systematic Botany, Mr. Potter; Morphology of the Flower, Mr. Hicks; Physiology of Plants, with Demonstrations, Mr. F. Darwin.

Geology, Local Stratigraphy, Prof. Hughes; Waves and Tides, Mr. Hill; Principles, Dynamical and Structural, Dr. Roberts; Irregular Accumulations of Doubtful Age and Origin, Mr. Marr; Palæontology, Wm. T. Roberts: Microscopic Petrology, Mr. Harker; Field Lectures, Prof. Hughes; Palæontology of Reptiles and Birds, Mr. Gadow.

Chemistry, General Equilibrium and the Dissipation of Energy, Prof. Liveing; Organic Chemistry, Mr. Main; Elementary Course, Mr. Pattison Muir; Course for Beginners, Mr. Sell; Gas Analysis, Jacksonian Assistant; Elementary Organic Chemistry, Mr. Heycock; Demonstrations, Mr. Sell, Mr. Fenton, Mr. Neville.

Physics: Optics, Prof. Stokes; Prof. Thomson, Kinetic Theory of Gases; Elementary and Advanced Courses, Mr. Shaw and Mr. Glazebrook; Elementary Physics, Mr. Hart; Demonstrations, Mr. Shaw and Mr. Glazebrook.

Mineralogy, Prof. Lewis; Demonstration Courses, Mr. Solly.

Machine Construction, Mr. Lyon; Surveying, Demonstrators of Mechanism.

Advanced Mathematical Lectures open to the University: Waves, Mr. Glazebrook; Elastic Solids, Mr. Macaulay; Solid Geometry, Mr. Ball; Analysis, Dr. Besant; Laplace's and Bessel's Functions, Mr. Pendlebury; Calculus of Variations, Mr. H. M. Taylor; Rigid Dynamics, Mr. Webb.

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